## REMARKS

These remarks were filed in response to the Office Action dated May 21, 2003, and they are repeated here for the convenience of the Examiner.

## Claim Rejections - 35 U.S.C. § 102

Claims 10, 17, 28 and 35 were rejected under 35 U.S.C. Section 102(b) as being anticipated by Kumagai et al. (US 4,810,597) ("Kumagai").

Regarding claims 10, 17, 28 and 35, briefly, Applicants' invention, provides a direct methanol fuel cell system which includes a fuel cell being used to power an application device, and in which, in response to changes in the output power level of the fuel cell, the concentration of methanol supplied to the anode is actively controlled, thereby minimizing methanol cross-over and maintaining efficiency over a wide operating range. In a variety of embodiments of the invention, the output power level of the operative fuel cell is sensed and a signal is sent to a concentration regulator that increases or decreases methanol concentration of the fuel to be supplied to the fuel cell, in response to the signal. In this way, methanol cross over is reduced because the correct amount of methanol is provided, as needed to the fuel cell, and this results in fuel cell efficiency being enhanced.

In contrast, Kumagai describes a device for detecting methanol concentration that includes a separate, sensor fuel cell, called a "unit cell" that is disposed within the fuel delivery pipe that supplies fuel to the primary fuel cell. The fuel being used in the overall system flows across the anode of the measuring cell and the open circuit voltage of the

measuring cell ("the unit cell") is sensed by a voltmeter associated with the unit cell. The sensed signal is used by a compensation device 18, which opens or closes a valve to deliver methanol and water on the basis of a relationship between the open-circuit voltage and methanol concentration. (Col. 3, line 67 – Col. 4 lines 1 – 6.) The Kumagai system is used for "maintaining the methanol concentration constant," (Col. 1, lines 52-53). Methanol is supplied to maintain a predetermined open-circuit potential whereby fuel at a substantially constant concentration within a predetermined range is supplied to the fuel cell. The Kumagai reference does not anticipate using a detector to sense changes in output power level of the operative fuel cell, nor does it produce a signal indicative of changes in the output power level as taught by Applicants and claimed in claim 10 and claim 17. Kumagai does not anticipate measuring output power level of a fuel cell and adjusting concentration responsively. Instead, Kumagai teaches employing a second fuel cell to measure fuel concentration by measuring the open circuit voltage of the second fuel cell. This in turn can be used to open or close a valve to change the fuel concentration, but a desired fuel concentration set point needs to be predetermined, and cannot be varied responsively to the fuel cell power output demand.

Kumagai simply does not anticipate using a signal to drive a concentration regulator which responsively controls the amount of methanol supplied to said fuel cell's anode in response to changes sensed in said output power level. Again, Kumagai is not responsive to changes in output power level of the main fuel cell, but instead responds to changes in the output of the unit cell, which is measuring the concentration of the incoming fuel, not the output of the operative fuel cell system.

In addition, Kumagai does not anticipate claim 28 (or dependent claim 35), because Kumagai does not teach sensing changes in potential at an anode or in a load level of the fuel cell system, nor does the cited reference teach using the sensed changes in potential to drive a concentration regulator which responsively controls the amount of methanol supplied to said fuel cell's anode when the power level increases and decreases. Moreover, Kumagai does not teach minimizing cross-over of methanol through said fuel cell's membrane electrolyte as claimed by Applicants.

Claims 10, 11, 28 and 29 were rejected under 35 U.S.C. Section 102(e) as being anticipated by Zhang et al. (US 6,527,943) ("Zhang").

Zhang describes a concentration sensor. Zhang's sensor is essentially a fuel cell with a resistor across the output of the fuel cell. Zhang's fuel cell is a sensor being used to determine fuel concentration, Zhang's cell is not being used to provide electricity to an application device. More specifically, in Zhang, the fluid mixture to be measured is supplied to a fuel flow field plate 5 (Fig. 1), and the electrical output of the sensor cell is measured to determine fuel concentration, not to provide electricity. To avoid saturating the sensor at high concentrations, Zhang teaches providing the concentration sensor with a lower load by using resistor 10 and operates the sensor at a greater oxidant stoichiometry than known sensors. Zhang further indicates that because the output of the fuel cell sensor will vary with temperature, then temperature control will be required. (Col. 6, lines 31-33.)

In contrast, Applicants' invention as claimed in independent claims 10 and 28 involves a fuel cell system including a fuel cell that is being used to power an application device, which includes it own means for sensing fuel concentration and for regulating fuel concentration via the associated concentration regulator. Applicants' method includes sensing the output power level of the fuel cell itself as it provides electricity, and either converting this to a signal as in claim 10, or using the potential directly as in claim 28 for adjusting concentration via a concentration regulator. Applicants' invention is not a sensor fuel cell used to obtain an accurate concentration reading as taught by Zhang. Applicants' invention is a fuel cell which provides power to a load that has fuel concentration feedback control, which has certain feedback mechanisms incorporated into the functional fuel cell, rather than relying solely on discrete sensors. This concentration regulation may be used in order to obtain a desired output power level of the operative fuel, or to minimize methanol crossover to thereby increase the efficiency of the fuel cell system. This is not taught or anticipated by Zhang because Zhang's device is simply a sensor that measures fuel concentration, and is not fuel cell operating to produce electricity that includes its own feedback for responsively adjusting methanol concentration according to output power. Zhang uses a fuel cell to measure concentration and is providing solutions for avoiding saturation of the measurement cell by employing the resistor 10 and controlling oxidant stoichiometry.

In summary, Zhang does not teach using a detector to detect changes in the output power level of a fuel cell being used to power an application device, and producing a signal indicative of those changes, and then employing this signal to drive a concentration regulator, as claimed in amended independent claim 10. Nor does Zhang teach sensing changes in potential at an anode or load level of the fuel cell system, and using directly the sensed changes in potential to drive a concentration regulator which responsively controls the amount of fuel supplied, as recited in Applicant's amended independent claim 28.

Accordingly, based upon the above arguments, it is respectfully submitted that claims 10, 28 and the claims dependent thereupon are patentably distinct from the cited prior art references.

**Allowable Subject Matter**

In a telephone conversation with the undersigned, the Examiner clarified that the objected to claims 12 – 16, 30 - 34, and 36 – 40 would be allowable if rewritten to include all of the elements of the base claims. Claim 12 has been rewritten in independent format, and claims 13-16 have been amended to depend upon claim 12.

Claims 17 and 18 depend upon claim 10, and based upon the amendments and arguments presented herein, it is respectfully submitted that they are now in condition for allowance.

Claims 19 –27 were previously cancelled in response to a restriction requirement.

Claim 30 has been rewritten herein, and claims 31 –34 have been amended herein to depend upon claim 30.

Claims 35 and 36 depend upon claim 28, and based upon the amendments and arguments presented herein, it is respectfully submitted that they are now in condition for allowance.

Claims 37 – 40 depend upon claim upon claim 10, and based upon the amendments and arguments presented herein, it is respectfully submitted that they are now in condition for allowance.

## SUMMARY

Based upon the foregoing amendments and arguments, it is respectfully submitted that all of the claims pending in this application are now in condition for allowance.

Please do not hesitate to contact the undersigned in order to advance the prosecution of this application in any respect.

Please charge any additional fee occasioned by this paper to our Deposit Account No. 03-1237.

Respectfully submitted,

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